Attorney Docket No.: 6502-1024

PATENT

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: VAN STRAATEN et al.

Appl. No.: 10/611,870

Filed: July 3, 2003

For: RESISTANCE ASSEMBLY

L E T T E R

Assistant Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Date: August 11, 2003

Sir:

Under the provisions of 35 U.S.C. § 119 and 37 C.F.R. § 1.55(a), the applicant(s) hereby claim(s) the right of priority based on the following application(s):

Country	Application No.	Filed
SOUTH AFRICA	2003/0392	January 15, 2003

A certified copy of the above-noted application(s) is(are) attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fee required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachment

Sertifikaat
PATENTKANTOOR
REPUBLIC OF SOUTH AFRICA

DEPARTEMENT VAN HANDEL
EN NYWERHEID

Certificate
PATENT OFFICE
REPUBLIEK VAN SUID-AFRIKA

DEPARTMENT OF TRADE AND
INDUSTRY

Hiermee word gesertifiseer dat
This is to certify that

the documents annexed hereto are true copies of:

Application forms P.1 and P.2, complete specification and drawings of South African Patent Application No. 2003/0392 as originally filed in the Republic of South Africa on 15 January 2003 in the names of VAN STRAATEN, WILLEM JOHANNES and PUZEY, MICHAEL ROYDON for an invention entitled:

" EXERCISE MACHINE ".

Geteken te PRETORIA in die Republiek van Suid-Afrika, hierdie **17th** dag van **July 2003**
Signed at PRETORIA in the Republic of South Africa, this **17th** day of **July 2003**

Registrateur van Patente

McCALLUM, RADEMEYER & FREIMOND
Ref: P.19772

FORM P1

REPUBLIEK VAN SUID-AFRIKA
REVENUE R 026600 INKOMSTE
FTR 074
REPUBLIC OF SOUTH-AFRICA

REVENUE INKOMSTE 15.1.03

REPUBLIC OF SOUTH AFRICA
PATENTS ACT,1978

APPLICATION FOR A PATENT AND ACKNOWLEDGEMENT OF RECEIPT

(Section 30(1) – Regulation 22)

The grant of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate

Revenue Stamps or Revenue Franking Machine Impression

OFFICIAL DATE STAMP

OFFICIAL APPLICATION NO.

21	A2003/0392

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TITLE OF INVENTION

54	EXERCISE MACHINE

Priority is claimed as set out on the accompanying Form P2.

The earliest priority claimed is: **N/A**

This application is a patent of addition to Patent Application No.	21	01	
This application is a fresh application in terms of section 37 and based on Application No.	21	01	

THIS APPLICATION IS ACCOMPANIED BY:

- ☐ 1 A single copy of a provisional specification of ..... pages
- ☒ 2 Two copies of a complete specification of ...23..... pages
- ☐ 3 .... Sheets of Informal Drawings
- ☒ 4 .....5..... Sheets of Formal Drawings
- ☒ 5 Publication particulars and abstract (Form P8 in duplicate)
- ☒ 6 A copy of Figure ...2... of drawings (if any) for the abstract
- ☐ 7 Assignment of Invention
- ☐ 8 Certified priority document(s) Number(s)
- ☐ 9 Translation of priority document(s)
- ☐ 10 An assignment of priority rights
- ☐ 11 A copy of the Form P2 and the specification of SA Patent Application
- ☒ 12 A declaration and power of attorney on Form P3
- ☐ 13 Request for ante-dating on Form P4
- ☐ 14 Request for classification on Form P9
- ☒ 15 Form P2 in duplicate

21	01	N/A

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Dated this 15th day of January 2003

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McCALLUM, RADEMEYER & FREIMOND
PATENT AGENTS FOR APPLICANT(S)

Received – Official Date Stamp

REGISTRAR OF PATENTS, DESIGNS, TRADE MARKS AND COPYRIGHT
2003 -01- 15
REGISTRAR OF PATENTS
REGISTRATEUR VAN PATENTE, MODELLE, HANDELSMERKE EN OUTEURSREG

FORM P2

MRF Ref:P.19772

REPUBLIC OF SOUTH AFRICA				PATENTS ACT, 1978	
REGISTRAR OF PATENTS					
Official Application No.		Lodging date: Provisional		Acceptance date:	
21	2003/0392	22		47	
International classification		Lodging date: Complete		Granted date:	
51	A63B	23	15 January 2003		

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Applicant(s) substituted:		Date Registered:
71		

Assignee(s):		Date Registered:
71		

Full name(s) of inventor(s)	
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Priority claimed		Country		Number		Date
Note:	33	NONE	31	NONE	32	NONE
Use International	33		31		32	
Abbreviation for Country	33		31		32	

Title of Invention:	
54	EXERCISE MACHINE

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Patent of Addition to Patent No.:	Date of any change:	
61		
Fresh Application based on:	Date of any change:	

McCALLUM, RADEMEYER & FREIMOND
Ref: P.19772

FORM P7

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

COMPLETE SPECIFICATION

(Section 30(1) – Regulation 28)

OFFICIAL APPLICATION NO

21	01	2003/0392

INTERNATIONAL CLASSIFICATION		LODGING DATE	
51	A63B	22	15 January 2003

FULL NAME(S) OF APPLICANT(S)

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TITLE OF INVENTION

54	EXERCISE MACHINE

BACKGROUND OF THE INVENTION

This invention relates to an exercise machine.

Exercise machines make use of diverse devices such as free weights, weight plates, elastic bands, springs and the like to provide a resistance force against which a user can exercise. It has been found that, in many of these machines, the stroke length, which is the distance against which a user moves his arms or legs, as the case may be, against a resistive force, must be reasonably long and this, in turn, means that an exercise machine must also be of substantial dimensions.

It is preferable to have a substantially constant resistance force, against which a user exercises, over the stroke length. If use is made of a spring or similar component, to provide the resistance force, then, as is known, the spring characteristic is such that the resistance force increases more or less linearly with spring deformation. In other words the more the resistance device is moved the greater is the resistance force which acts against movement from the user. This is not necessarily a desirable characteristic.

If one or more weights are used to provide the resistance force then a substantially constant resistance force is obtained over the stroke length. When a user who is physically strong makes use of the exercise machine then the number of weights which must be provided is substantial and this carries with it a penalty in that the exercise machine is then not necessarily

easily transportable and, inevitably, the exercise machine is cumbersome and expensive to ship to a customer.

Another factor is that the positive resistance force, which is the resistance force displayed by the resistance device when energy is put into an exercise machine by a user, should, as far as is possible, be the same as the negative resistance force which results when energy which is stored in the exercise machine is released, on a return stroke. These forces can only be matched to one another, at least to some extent, if frictional and similar losses are minimised.

It should be possible, particularly for a device which is intended for a home user, to be able to adjust the resistance force, exhibited by an exercise machine, with relative ease. The exercise machine should, as noted, be compact and light so that it is suited for easy storage and transport. It is also desirable to be able to use the machine in one of at least two modes eg. by working against a resistance force by pulling downwardly on an actuator which may be of any suitable form eg. a handle, a bar, an ankle or wrist cuff, or the like, or by working against a resistance force by pulling upwardly on an actuator. These modes are given merely by way of example for the exercise machine could be constructed to provide the resistance force against other types of movement eg. a pushing or a rotating movement by the user.

SUMMARY OF INVENTION

The invention provides an exercise machine which includes a frame, at least a first resistance assembly supported by the frame, and at least a first actuator which is movable by a user from a first rest position against a resistance force which is dependent at least on the resistance assembly, to cause movement of at least a first part of the resistance assembly.

The first actuator may include at least a first device, eg. a handle, which is movable by a user and a first mechanical advantage system connected to the resistance assembly whereby movement of the first device by a first distance causes corresponding movement of the at least first part of the resistance assembly by a second distance which is smaller than the first distance.

The resistance assembly may include first and second ends and, when the at least first part of the assembly is caused to move by the first actuator, the first end may engage with a first support on the frame and the second end may move relatively to the frame.

The exercise machine may include a second actuator which is movable by a user from a second rest position against a resistance force which is dependent at least on the resistance assembly to cause movement of at least a second part of the resistance assembly and, when the at least second part of the assembly is caused to move by the second actuator, the second end may engage with a second support on the frame and the first end may move relatively to the frame.

The first actuator may be movable in any appropriate way for example by a user pulling or pushing downwardly from the first rest position which may be at an upper location. The second actuator on the other hand may be movable by a user pulling or pushing upwardly from the second rest position which may be at a lower location.

Depending on the construction of the machine the resistance force may be generated when a user causes rotation of at least one actuator through an arc or along a curved path.

The second actuator may be similar to the first actuator in that it may include at least a second device which is movable by a user and a second mechanical advantage system connected to the resistance assembly whereby movement of the second device by a first distance causes corresponding movement of the at least second part of the resistance assembly by a second distance which is smaller than the first distance.

The first mechanical advantage system may, in a relatively simple form, comprise a cable and pulley system. The system may be designed so that movement of the first actuator through the first distance is greater than the corresponding resulting movement of the resistance assembly through the second distance. The mechanical advantage, in this respect, may be of the order of 2:1 but, preferably, is of the order of 4:1. Other ratios are possible. This feature carries with it the benefit that the stroke length is materially increased compared to the distance by which the resistance assembly is

caused to move. The second mechanical advantage system may be similar in nature.

It is important however to minimize frictional energy losses, particularly in a cable or pulley system. Thus the number of pulleys in the system should be restricted, where possible.

The aforementioned arrangement means that it is possible to reduce the size of the exercise machine whilst maintaining a substantial stroke length. In order for the stroke length to take place against a fairly high resistance force it is necessary however for the resistance assembly to exhibit a substantial resistance force for, with a mechanical advantage of the order of 4, the force which is exerted on the first actuator is about a quarter of the resistance force.

The resistance assembly may be of any appropriate type. In a preferred embodiment of the invention the resistance assembly is a piston and cylinder assembly and the exercise machine includes apparatus for establishing a controlled fluid pressure inside the cylinder whereby the resistance force is dependent at least on the fluid pressure inside the cylinder.

Preferably the fluid is air and a compressor is used to compress air inside the cylinder. A relief valve may be provided for releasing air from the cylinder. An advantage of this arrangement is that it is possible for a user to pressurise the cylinder easily to a level which sets a desired resistance force against which the user exercises.

The compressor is preferably a small device mounted in or on a housing, or part of the frame, of the exercise machine. A housing, which contains the compressor, may be provided as a foot piece attached to the frame and foot operated controls for operating the compressor and adjusting the fluid pressure inside the cylinder may be provided on the housing.

The compressor, and a motor to drive the compressor, could however be mounted remotely from the frame, particularly in a gymnasium installation wherein a number of machines could be pressurized from a single compressor.

The controls are conveniently foot-operated, particularly if the machine is "self-contained", but hand-operated controls, remotely operated controls eg. radio-based, or even voice-operated controls could be employed to regulate the pressure inside the cylinder.

Movement of the first actuator may cause telescoping movement of the piston and cylinder assembly.

The arrangement may be such that the fluid pressure in the assembly is increased by the telescoping movement of the assembly and a force is generated which tends to extend the assembly and restore the first actuator to the rest position.

In a preferred arrangement the piston includes a piston head which is mounted for reciprocating movement inside the cylinder and a piston rod

which is attached to the piston head and which extends from the cylinder, the fluid pressure inside the cylinder on opposed sides of the piston head being the same, and wherein an increase in fluid pressure, due to the telescoping movement, is dependent on the extent to which the piston rod extends into the cylinder.

As an alternative to a motor-driven compressor used could be made of a gas cylinder which contains pressurized air and which is recharged when necessary. The gas cylinder can be used to pressurize the piston and cylinder in the exercise machine in the same way as the motor-driven compressor. The gas cylinder could be "on-board" or installed at a position which is remote from the exercise machine or machines which it pressurises.

The piston rod is preferably formed with a hollow interior, ie. is tubular, and has a sealed end which is remote from the cylinder and an open mouth which is located inside the cylinder so that the fluid pressure in the hollow interior is the same as the fluid pressure inside the cylinder.

In a different embodiment of the invention the resistance assembly includes at least one resiliently deformable member. This member may be in the nature of a coil spring or the like but conveniently is an elastically extensible band. A number of bands may be used in the resistance assembly and the arrangement may be such that the number of bands may be varied according to the user's requirements to adjust the resistance force against which a user

exercise. The tension in the bands can also be adjusted to vary the resistance force.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is further described by way of examples with reference to the accompanying drawings in which:

Figure 1 is a side view of an exercise machine according to the invention in a ready-to-use state;

Figure 2 is a perspective view from the front of the machine with certain components removed to simplify the illustration;

Figure 3 illustrates moving components of the exercise machine of Figure 1;

Figure 4 is a view similar to Figure 3 of an exercise machine which makes use of a different type of resistance assembly from what is employed in the machine of Figures 1 to 3;

Figure 5 is a side view of the arrangement of Figure 4, and

Figure 6 is an enlarged perspective view of a connection plate used in the arrangement of Figure 4.

DESCRIPTION OF PREFERRED EMBODIMENTS

Figures 1 to 3 of the accompanying drawings illustrate an exercise machine 10 according to a first form of the invention.

The exercise machine includes a frame 12 to which is attached a seat 16 on which a user can be seated, and a backrest 18 for the back of a user

positioned on the seat. For storage and transport purposes the seat 16, which is normally braced by one or more stays 20, can be folded downwardly so that it is substantially parallel to the frame while, in a similar fashion, the backrest 18 which is braced by one or more stays 22 can be pivoted towards the frame to take up a compact position. A headrest 24 can be used at an upper end of the frame particularly if the backrest is moved to a compact storage position adjacent the frame.

The frame is supported at an inclined position relatively to the ground 26 by a downwardly depending U-member 28 which is attached at a pivot point 30 to brackets 32 on a rear side of the frame 12. The U-member 28 can be moved inwardly towards the frame 12 for storage and transport purposes or, as is shown in Figure 1, can be moved away from the frame to provide a maximum degree of stable support for the frame.

The exercise machine includes a foot piece 36 at a foot of the frame. The foot piece forms a housing in which are located an electric motor 38 and an air pump or compressor 40 which is driven by the motor and which delivers air via a flexible pipe 42 to a cylinder 44 which is supported by the frame 12.

An upper surface 46 of the foot piece housing is serrated or roughened and provides a reactive surface against which feet of a user, positioned on the seat, react.

A flexible electric cord 50 extends from the motor to a main electrical supply point, not shown. A switch 52 on the foot piece 36 can be actuated by a foot

of a user to connect the motor 38 to the main supply or turn the electrical supply off. In this way the operation of the motor 38 can be controlled. A pressure relief valve 60 is connected to the cylinder 44 via a flexible line 62. The pressure relief valve can also be operated by means of a foot of a user. Thus it is possible for the user to turn the compressor on and thereby pressurise the cylinder 44; turn the compressor off; or reduce the pressure inside the cylinder by actuating the valve 60.

The cylinder 44 is connected to a piston 70 to make up an assembly 72 which provides a resistance force for a user. The manner in which this is achieved is described hereinafter. The cylinder 44 has a lower end 74 which is sealed and which is mounted to a lower wheeled carriage 76. The piston 70 has a piston head 78 which is mounted for reciprocating movement inside the cylinder and a piston rod 80 which extends from the head. An upper end of the rod is mounted to an upper wheeled carriage 82.

A first pulley and cable system 84 is mounted to act on the lower carriage 76 while a second pulley and cable system 86 is mounted to act on the upper carriage 82. The system 84 includes a pair of handles 88A and 88B which are connected to each other by means of a cable 90 which passes over a succession of pulleys 92A to 92E respectively. The pulley 92C is connected to the carriage 76 by means of a cable 98 which passes over pulleys 100A and 100B on the carriage. An end of the cable 98 is attached to an anchor point 102 on the frame 12.

The system 86 has handles 108A and 108B respectively at a lower side of the frame which are connected to a cable 110 which passes over pulleys 112A to 112E respectively. The pulley 112C is connected to the carriage 82 by means of a cable 114 which passes over pulleys 116A and 116B which are mounted to the carriage. An end of the cable is tied to an anchor point 118 on the frame.

It is evident from Figure 2 that the piston head 78 acts only in a guiding capacity within the cylinder. The piston head is formed with a plurality of notches or cut-outs 120 and consequently the pressure inside the cylinder on one side of the piston head is the same as the pressure on an opposing side of the head.

The piston rod 80 is tubular and consequently its interior 122 is hollow. A plug 124 seals an upper end of the rod 80. A lower end of the rod, which is connected to the piston head 78, is open and forms a mouth 126 which places the interior of the cylinder 44 in communication with the hollow interior of the rod.

When the exercise machine is to be used the frame 12 is positioned so that it has the orientation shown in Figure 1. A user positions himself on the seat 16 with his back against the backrest 18. The user activates the switch 52 with one of his feet and the motor 38 is energised and then drives the compressor 40. Once the interior of the cylinder 44 has been pressurised to a desired air pressure the motor is turned off. If pressure is too high the pressure relief

valve 60 is actuated to allow air to escape from the cylinder. It is therefore relatively easy for a user to adjust or control the pressure inside the cylinder using the foot-operated controls 52 and 60.

Assume that the user grips the upper handles 88A and 88B and pulls downwardly on the handles as is indicated by arrows 130 in Figure 3. Due to the pulley and cable system 84 the lower carriage 76 is elevated and the cylinder rises with the piston moving with a telescoping action into the cylinder. A resistance force is generated which tends to act against the aforementioned movement as the rod 80 is forced into the cylinder. The effective volume which is occupied by the pressured air inside the cylinder and the hollow piston rod 80 is reduced depending on the extent to which the rod extends into the cylinder 44.

If the pressure inside the cylinder 44 is relatively high then a significant force is needed to move the rod 80 into the cylinder. However as the volume of the interior of the rod 80 is comparatively small compared to the volume of the cylinder 44, the force which is needed to move the rod into the cylinder increases only slightly as the rod extends to a greater extent into the cylinder. In other words over the stroke length represented by the downward movement of the handles 88A and 88B, the resistance force displayed by the piston and cylinder assembly 72 increases only slightly.

Due to the mechanical advantage of the system 84 the stroke length of the handles 88A and 88B is four times the stroke length of the piston into the

cylinder. Thus the piston and cylinder assembly can be relatively compact compared to the stroke length of the exercise machine. This carries a further benefit in that the change in pressure, inside the cylinder, as the assembly is telescoped is restricted because the extent of movement of the piston relatively to the cylinder is limited.

During the aforementioned telescoping movement of the assembly 72 the upper end of the piston rod is supported by the carriage 82 which in turn is supported by a bracing member or formation 140 on the frame 12. On the other hand when the handles 108A and 108B are gripped and pulled upwardly, in the direction of arrows 142, the upper carriage 82 moves downwardly and the lower end 74 of the cylinder 44, which is mounted to the lower carriage 76, is prevented from moving by a support or bracing member 146 of the frame.

The handles 108A and 108B exhibit the same relatively long stroke length, compared to the stroke length of the piston into the cylinder, as the handles 88A and 88B.

The exercise machine 10 has a number of significant benefits. Firstly, it is possible for a user to adjust the pressure inside the cylinder 44 and this in turn means that the user can adjust the resistance force according to his physical condition even while exercising. The adjustment is done without the user needing to disengage his hands from the handles 88 or 108, as the case may be. Secondly, as noted, the stroke length which results when the handles 88

or 108 are used is four times the stroke length of the piston into the cylinder. This allows for a compact construction of the exercise machine.

Thirdly, the number of pulleys in each of the systems 84 and 86 is relatively low and this means that frictional losses are kept to a minimum. Consequently the positive resistance force displayed by the piston and cylinder assembly 72 (ie. the force which results when the handles 88 are moved in the direction of the arrows 130 or when the handles 108 are moved in the direction of the arrows 142) is only slightly greater than the negative resistance force which is the force produced when the air inside the cylinder 44 expands to restore the piston and cylinder assembly to its extended position.

A further benefit, already alluded to, is that the force which is needed to drive the piston rod deeper into the cylinder increases only slightly as the rod extends into the cylinder. This force is a function of the pressure inside the cylinder and if the pressure is sufficiently high the relative increase in the force, as the piston moves into the cylinder, is comparatively low. The extent to which the force increases is a function of the relative volumes of the cylinder 44 and of the interior of the hollow rod 80.

The exercise machine is lightweight. The resistance force results from the use of a cylinder and piston assembly which is pressurised with air by a user to a chosen, controlled level which is readily adjustable. The need for heavy weights is therefore eliminated. The exercise machine can be folded

compactly into a fairly flat arrangement which can, for example, be stored under a bed or behind a door when not required. In this respect it should be observed that the compressor and motor are mounted in the housing 36 and are therefore integrally associated with the exercise machine. As is indicated by a curved arrow 158 in Figure 1 the housing can be folded upwardly to a compact storage position, adjacent the frame, when required. The exercise machine is thus a fully self-contained unit and only requires connection to an electrical supply to become operational. The same principles could however be employed to provide an exercise machine, which may be one of a plurality of similar machines, which is pressurized from a remotely installed compressor. The pressure in each machine could then be controlled as required by each respective user.

In each case the controls could be foot-operated. However hand-operated, remotely activated, and voice actuated controls could also be used to regulate the pressure in the cylinder.

Figures 4 to 6 illustrate a modification which can be made to the machine 10. Use is made of a plurality of elastic bands 160 in place of the piston and cylinder assembly 72. Where applicable like reference numerals are used to designate like components.

Figure 4 shows three bands designated 160A, 160B and 160C which pass over corresponding pulleys 162A, 162B and 162C. Ends of the bands are terminated in knobs 164A to 164C respectively.

A corresponding construction is adopted for the bands at their lower ends. As is shown in Figure 4 the lower ends of the bands pass around pulleys 166 which are similar to the pulleys 162. The lower ends are attached to a plate 168. In each case the knob of a respective band is engaged with a slot 170 in the plate.

The plate 168 has a pulley 172 fixed to its rear side. An inextensible cable 90 passes over pulleys 92 and is terminated in handles 88, similar to what is shown in Figure 3. It is apparent that the pulley 172 serves the same function as the pulley 92C and that the plate 168 is equivalent to the lower carriage 76. When the handles 88A and 88B are pulled downwardly the plate 168 is moved upwardly and the bands 160 are tensioned. The lower ends of the bands move upwardly while the upper ends which are fixed to the knobs 164 remain stationary.

In reality the knobs 164 at the upper ends of the bands are fixed to a plate 176 which is similar to the plate 168 and which acts in the same way as the upper carriage 82 (see Figure 6). A cable 178, which is equivalent to the cable 110 and which terminates in handles 108A and 108B similar to those shown in Figure 3, passes around a corresponding set of pulleys and acts on the upper plate 176. If an upwards pulling force is applied to the handles which are fixed to the ends of the cable 178 the plate 176 is moved downwardly with the lower plate 168 then remaining stationary.

The exercise machine modified in accordance with Figures 4 to 6 provides a dual-acting arrangement in which a pulling or pushing force can be exerted upwardly or downwardly and wherein the mechanical advantage of the modified system is at a chosen value, typically 4:1. Three bands are shown in Figure 4. This number can be varied by a user who can select one, two or three bands against which to exercise.

Normally the bands, at the rest position shown in Figure 4, are relatively unextended and the resistance force, at the start of a stroke length, is relatively low. It is possible though to provide an adjustment mechanism in that one or more bands can be passed around intermediate pulleys 180 and 182 as is shown in the inset drawing in Figure 4. If the distance 184 between the axes on which the respective pulleys rotate, is adjusted, then the band tension can be adjusted as well. This is equivalent to varying the air pressure in the piston and cylinder assembly shown in Figure 1.

CLAIMS

1. An exercise machine which includes a frame, at least a first resistance assembly supported by the frame, and at least a first actuator which is movable by a user from a first rest position against a resistance force which is dependent at least on the resistance assembly, to cause movement of at least a first part of the resistance assembly.

2. An exercise machine according to claim 1 wherein the first actuator includes at least a first device which is movable by a user and a first mechanical advantage system connected to the resistance assembly whereby movement of the first device by a first distance causes corresponding movement of the at least first part of the resistance assembly by a second distance which is smaller than the first distance.

3. An exercise machine according to claim 1 or 2 wherein the resistance assembly includes first and second ends and wherein when the at least first part of the assembly is caused to move by the first actuator, the first end engages with a first support on the frame and the second end moves relatively to the frame.

4. An exercise machine according to claim 3 which includes a second actuator which is movable by a user from a second rest position against a resistance force which is dependent at least on the resistance assembly, to cause movement of at least a second part of

the resistance assembly and wherein, when the assembly is caused to move by the second actuator, the second end engages with a second support on the frame and the first end moves relatively to the frame.

5. An exercise machine according to claim 4 wherein the second actuator includes at least a second device which is movable by a user and a second mechanical advantage system connected to the resistance assembly whereby movement of the second device by a first distance causes corresponding movement of the at least second part of the resistance assembly by a second distance which is smaller than the first distance.

6. An exercise machine according to any one of claims 1 to 5 wherein the resistance assembly is a piston and cylinder assembly, and which includes apparatus for establishing a controlled fluid pressure inside the cylinder whereby the resistance force is dependent at least on the fluid pressure inside the cylinder.

7. An exercise machine according to claim 6 wherein movement of the first actuator causes telescoping movement of the piston and cylinder assembly.

8. An exercise machine according to claim 7 wherein the fluid pressure is increased by the telescoping movement of the assembly, and exerts a force which tends to extend the assembly and restore the first actuator to the first rest position.

9. An exercise machine according to claim 8 wherein the piston includes a piston head which is mounted for reciprocating movement inside the cylinder and a piston rod which is attached to the piston head and which extends from the cylinder, the fluid pressure inside the cylinder on opposed sides of the piston head being the same, and wherein the increase in fluid pressure, due to the telescoping movement, is dependent on the extent to which the piston rod extends into the cylinder.

10. An exercise machine according to claim 9 wherein the piston rod includes a hollow interior and has a sealed end which is remote from the cylinder and an open mouth which is located inside the cylinder whereby the fluid pressure in the hollow interior is the same as inside the cylinder.

11. An exercise machine according to any one of claims 6 to 10 wherein the apparatus includes a fluid pump for pressurising fluid inside the cylinder and a pressure relief device for reducing in a controlled manner the pressure of the fluid inside the cylinder.

12. An exercise machine according to any one of claims 6 to 10 wherein the apparatus includes a gas-pressurised cylinder.

13. An exercise machine according to any one of claims 6 to 12 wherein the apparatus is positioned inside a housing which is mounted to the frame.

14. An exercise machine according to any one of claims 6 to 12 wherein the apparatus is positioned remotely from the frame.

15. An exercise machine according to any one of claims 6 to 14 which includes controls for controlling the fluid pressure inside the cylinder.

16. An exercise machine according to claim 15 wherein the controls are foot-operated.

17. An exercise machine according to any one of claims 1 to 5 wherein the resistance assembly includes at least one resiliently deformable member.

18. An exercise machine according to claim 17 wherein the resiliently deformable member is an elastically extensible band.

19. An exercise machine according to claim 18 which includes a plurality of the bands and wherein the number of the bands in the resistance assembly can be varied.

20. An exercise machine which includes a frame, a piston and cylinder assembly positioned between opposed members on the frame, apparatus for pressurising an interior of the cylinder, a first mechanical advantage system operable by a user to telescope the assembly by moving the piston relatively to the frame with the cylinder stationary, and a second mechanical advantage system operable by a user to

telescope the assembly by moving the cylinder relatively to the frame with the piston stationary.

21. An exercise machine which includes a frame, a piston and cylinder assembly mounted to the frame, a source of pressurized air for pressurising an interior of the cylinder, and at least one actuator for causing telescopic movement of the assembly against a resistance force which depends at least on the pressure in the cylinder interior.

22. A resistance assembly for use in an exercise machine which includes a cylinder, a piston with a piston head which is mounted for reciprocating movement inside the cylinder, and a hollow piston rod which is connected to the piston head and which extends from the cylinder, and a source of pressurized air for pressurizing the interior of the cylinder, on each side of the piston head, and the interior of the hollow piston rod.

Dated this 15th day of January 2003.

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Patent Agents for the Applicant

P.19772/jes

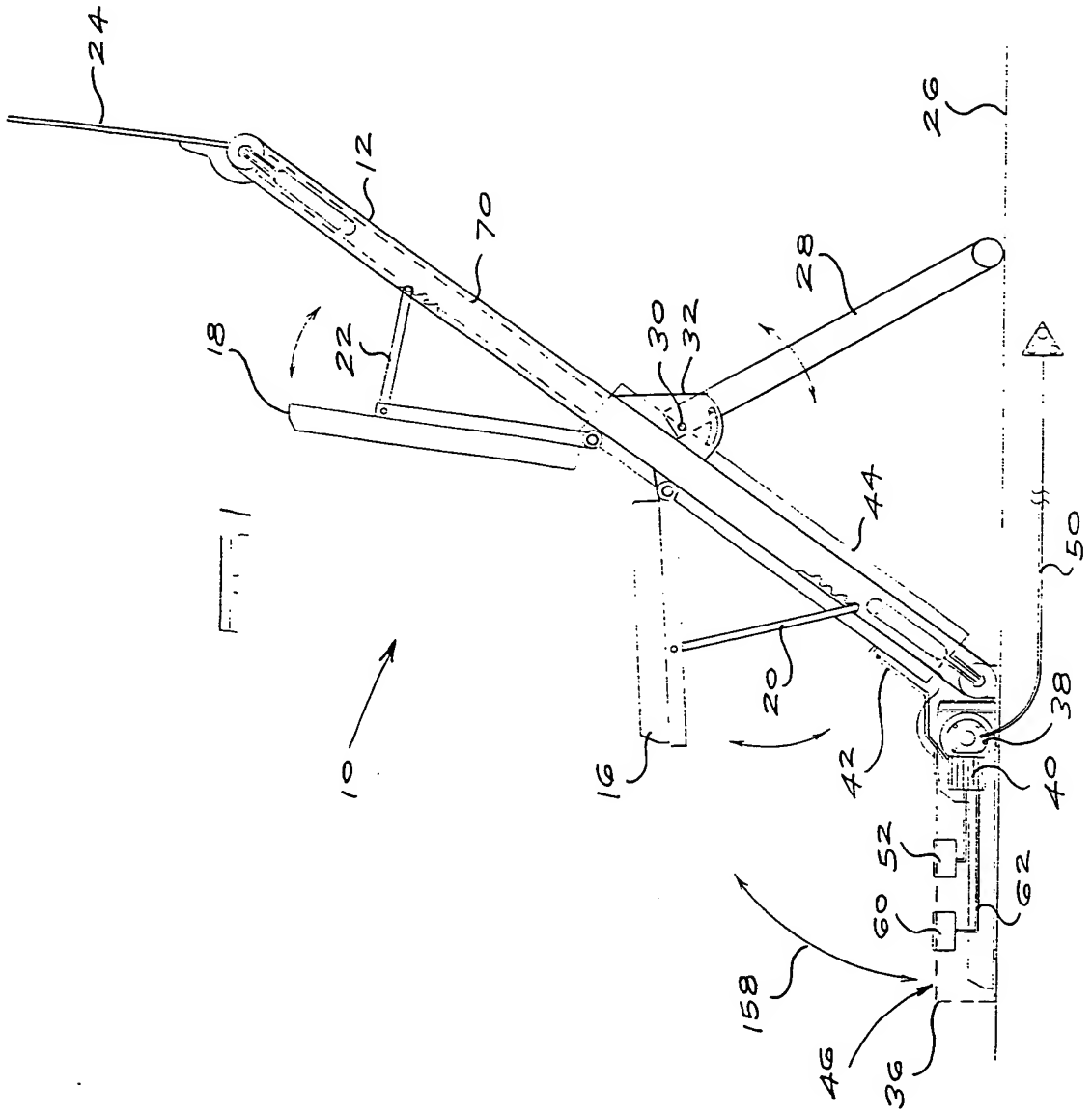

FIG. 1

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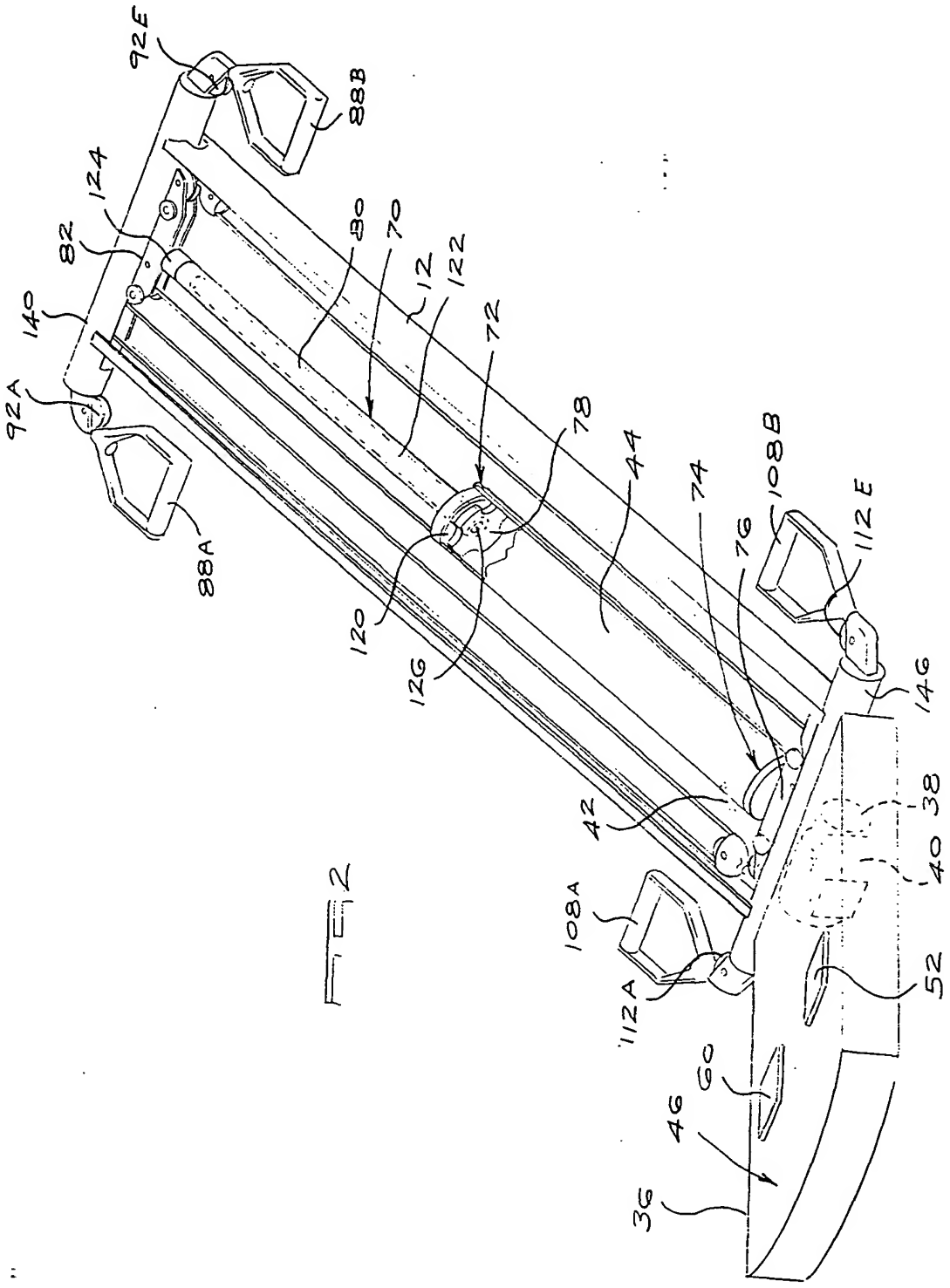

FIG 2

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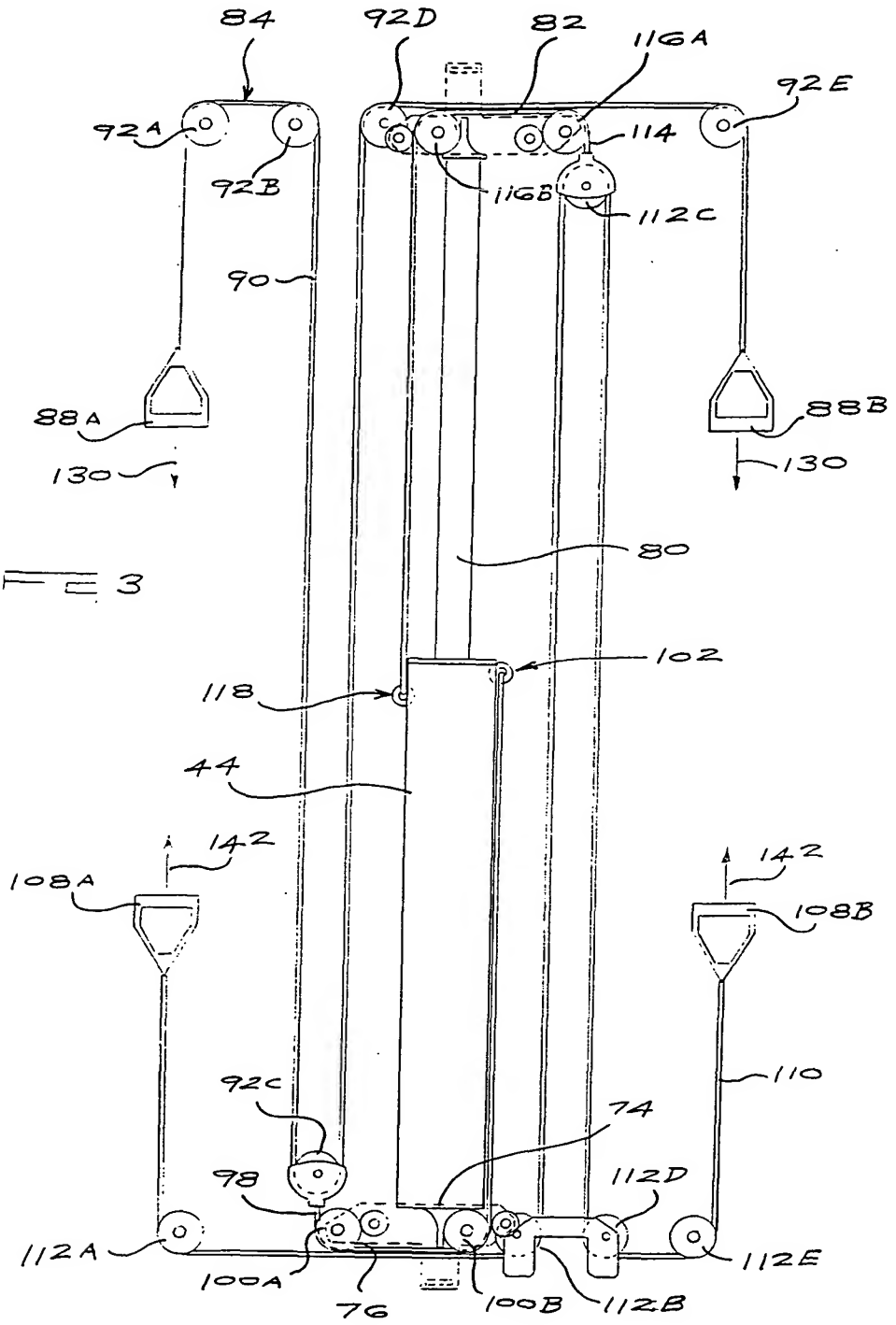

FIG 3

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FIG 4

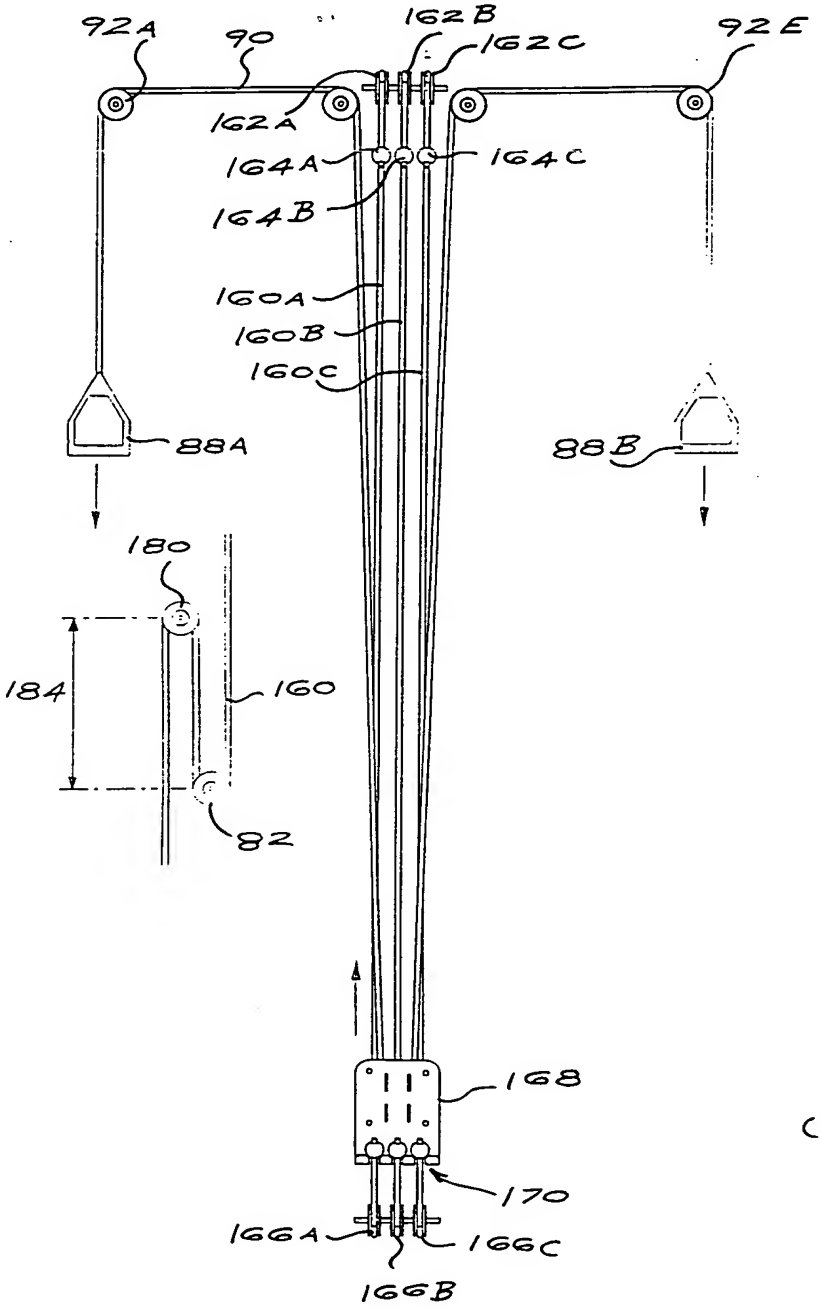

FIG 5

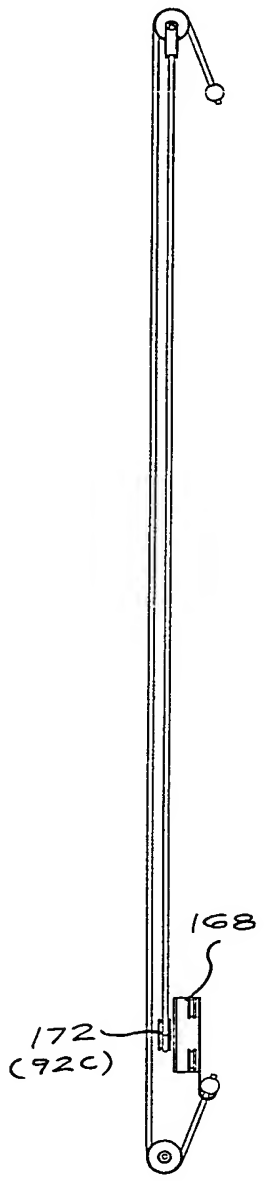

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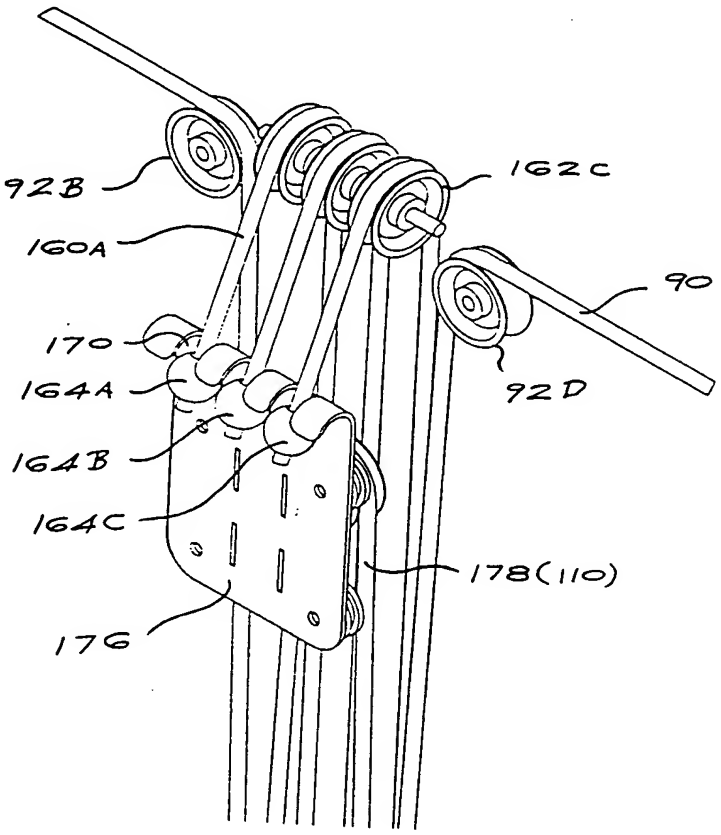
FIG 6



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